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Hydroids and pearls from the mussel *Mytilus galloprovincialis* in the SW coast of South Africa

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南アフリカ南西部海岸産のイガイ類に見られるヒドロ虫類と真珠

久保田 信¹・エマニエル・ブユウヒャー²

Abstract The bivalve-inhabiting and epizoid hydroids of *Mytilus galloprovincialis*, an introduced species, were surveyed in Langebaan Lagoon and vicinity, SW coast of South Africa, in January, 2003. A total of 490 mussels collected from five sites did not harbour any bivalve-inhabiting hydroids in the mantle cavity, and only four hydroid species were found attached to the shell. On the other hand, an extraordinarily high number of pearls, 40 in all, was embedded in both sides of the mantle of one individual of the mussel, and many pearl-like protuberances were produced on the inner surface of its shell.

Key words mussels, *Mytilus galloprovincialis*, hydroids, pearl, pearl-like protuberance, South Africa

Introduction

Bivalve-inhabiting hydrozoans are unusual in living within the mantle cavity of various bivalve species (Kubota, 1983). This symbiosis between hydrozoans and mollusks is not a species-specific association, and it has been observed around the world (Kubota, 1989, 2003; Piraino *et al.*, 1994; Kubota and Larson, 1990; Kubota *et al.*, 1999, 2003). These hydroids are distributed in tropical and temperate areas, usually being rare in cold regions (Kubota, 1987, 2000). Due to their solitary growth form, these bivalve-inhabiting hydrozoans look like a freshwater *Hydra*, whereas common

thecate hydroids are generally colonial and protected by a well-developed periderm, i.e. hydrotheca and gonotheca. During the warm season these hydroids produce medusae, which will later undertake sexual reproduction in the water column. The morphology of the liberated medusae varies from a very reduced form like *Eugymnanthea* to a more common form like *Eutima*.

In Hokkaido, the northernmost region of Japan, some exceptional geographic range of a bivalve-inhabiting hydrozoan have been recorded (Kubota, 1979, 1992). In winter the water temperature drops to

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about 2°C at Oshoro, western Hokkaido, facing the Sea of Japan, and lower than this temperature at Akkeshi, eastern Hokkaido, facing the Pacific Ocean and influenced by the cold Chishima Current. These temperatures are really too cold for the present hydrozoans due to their tropical origin, and the free medusa can not survive below 15°C (Kubota, 1987). However, due to the effect of the warm Tsushima Current, a branch of the Kuroshio Current, the water can reach temperatures higher than 25°C in summer and autumn at Oshoro. One of the bivalve-inhabiting hydroids, the northern form of *Eutima japonica* Uchida, can thus be found sporadically along the SW coast of Hokkaido, having become eurythermally adapted to the cold temperatures (Kubota, 1983, 1987, 1992).

Based mainly on these observations made in Japan, we expected to find bivalve-inhabiting hydrozoans along the southern coasts of South Africa, where a warm current (the Agulhas Current) and a cold current (the Benguela Current) influence the hydrobiology of the area. We thus conducted a survey in and around the Langebaan Lagoon to confirm this prediction.

Other facts suggest that a likelihood of finding bivalve-inhabiting hydrozoans there. Millard (1975) recognized of 286 hydrozoan species in southern Africa, of which 48 were collected around the present study area. This is the type locality for three of them. There is thus a high endemic/indigenous diversity of hydrozoans in the Langebaan Lagoon and vicinity. The mussel populations are also considered to be rich in this area (Branch *et al.*, 1994).

The present note reports the results

of this survey, which also included the epizoid hydroids on the shell surface of the mussels as well as the bivalve-inhabiting hydroids. Furthermore, the extraordinarily high number of pearls found inside one mussel is reported.

Materials and Methods

During the period between January 9 and January 16, 2003, a faunistic survey of bivalve-inhabiting and epizoid hydrozoans was conducted on mussels from the Langebaan Lagoon (33°05'S, 18°E) and its vicinity. Mussels were collected in the intertidal zones at five different sites (Fig. 1, Table 1). The Mediterranean mussel, *Mytilus galloprovincialis*, which has been introduced recently in the region (Branch *et al.*, 1994), is replacing the indigenous black mussel, *Chloromytilus meridionalis*. The studied mussels were mostly the invasive *M. galloprovincialis* because the local species *C. meridionalis* has become very rare. All 479 *M. galloprovincialis* from the five sites and five *C. meridionalis* from Saldanha Bay were examined soon after collection under a stereoscopic microscope to confirm the presence of any bivalve-inhabiting hydroids on soft body portions and also epizoid hydroids on the shell surface. The adductor muscle of each mussel was cut with a knife and the surface of all the soft body portions of the mantle cavity was carefully examined. Occurrence of hydrozoans on the shell surface was also meticulously studied. An additional 11 specimens of *M. galloprovincialis*, attached to a split-fan kelp, *Ecklonia maxima*, which washed up on the beach at Postberg, were also examined.

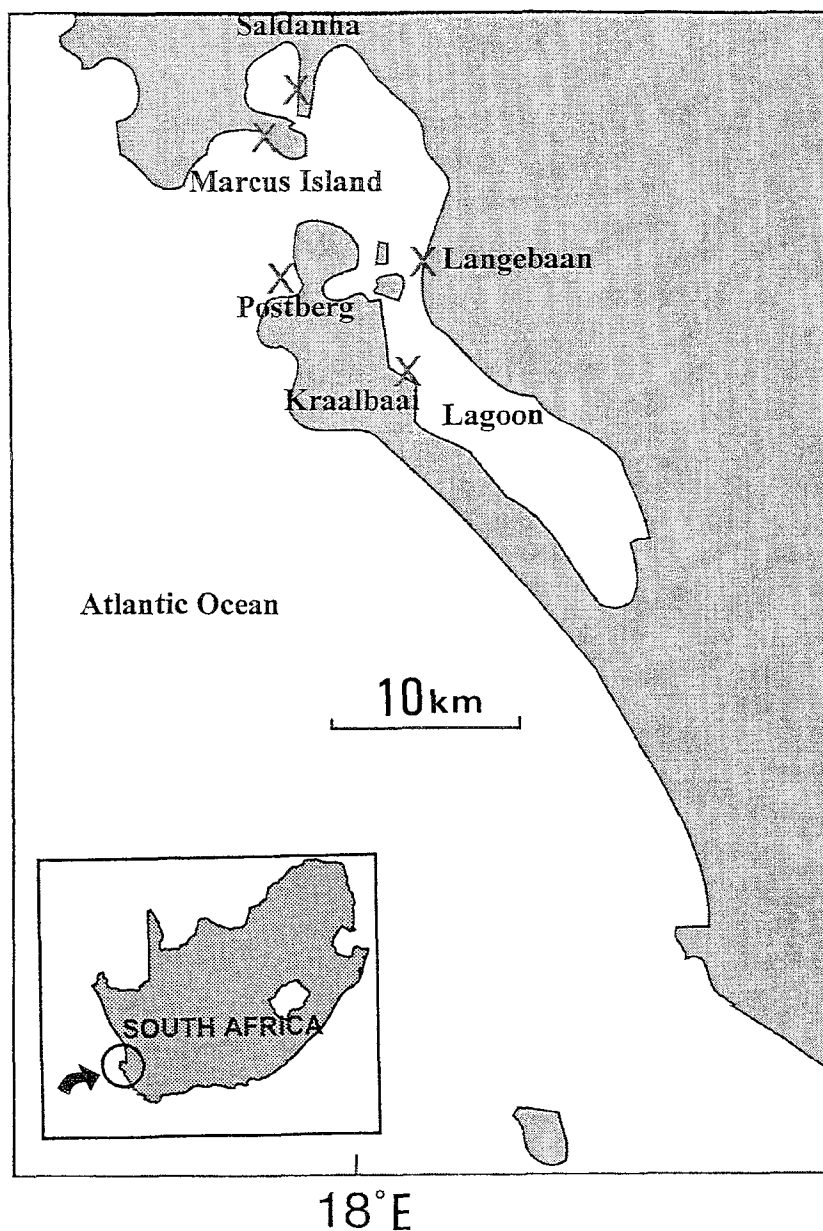


Fig. 1. Map of collection sites in Langebaan Lagoon and vicinity, SW coast of South Africa.

Results and Discussion

(1) Survey of epizoid and bivalve-inhabiting hydrozoans

Four hydrozoan species, one athecate (*Coryne eximia?*) and three thecates (*Kirchenpauria pinnata*, *Calycella* sp.,

Obelia sp.), were found on the shell of seven mussel individuals from Langebaan (Table 1). The colonies of the two latter species were small and lacked gonophores, which made their identification difficult. No bivalve-inhabiting hydrozoans were

Table 1. Occurrence of bivalve-inhabiting and epizoic hydroids from *Mytilus galloprovincialis* in Langebaan Lagoon and vicinity, SW coast of South Africa. 8

Site	Environment	Substratum of mussel attachment	Number of mussels examined	Size (anterior-posterior axes) of mussels (mm)	Hydroids in the mantle cavity	Hydroids externally on the shell (No. of colonies=host individuals)
Langebaan	Sheltered	Rock	80	39-74	No	No
Langebaan	Sheltered	Wrecked ship and floating log	35	26-65	No	<i>Coryne eximia</i> ? (2) <i>Kirchenpaueria pinnata</i> (2) <i>Obelia</i> sp. ? (2) <i>Calycella</i> sp. ? (1)
Kraalbaai	Sheltered	Wooden pier	111	38-70	No	No
Saldanha Bay	Sheltered	Rock	102	40-71	No	No
Postberg	Exposed	Rock	99	39-77	No	No
Postberg	Exposed	Kelp (washed <i>Ecklonia</i>)	11	26-59	No	No
near Marcus Island	Exposed	Rock	52	34-76	No	No

found in the mantle cavity of any individual among the 490 examined mussels attached to different substrata (Table 1).

Kubota has observed tens of thousands of mussels from various places all over the world (Kubota, 2000, unpublished data) and incidences of complete absence are uncommon. Such an absence was once noticed at several localities on the east coast of the United States, influenced permanently by a cold current (surveyed in September and October, 1998, by Kubota, unpubl. data; cf. Kubota, 1998). It is worthwhile to note here that neither commensal pinnotheriid crabs nor parasitic copepods (Kubota *et al.*, 1999) were found in these mussels from South Africa. The reason for the absence of bivalve-inhabiting hydrozoans in this region, where they might be expected, is unclear.

(2) Record of an extraordinarily high number of pearls and pearl-like protuberances

It is well-known that bivalves sometimes bear natural pearls within their mantle. Observations on tens of thousands of bivalves have been carried out by Kubota over the last 25 years. On the Japanese seacoast, few *Mytilus* specimens have been seen with pearls in their mantle cavity, and if pearls were present, they were never abundant and usually below ten in number per mussel (Kubota, unpubl. data).

In the present study, one specimen of *M. galloprovincialis* collected on an intertidal rock in Saldanha Bay on January 16, 2003, had a surprisingly high number of pearls. The size of the mussel was 52 mm along its anterior-posterior axis. The number of pearls was 21 on the right side of the mantle (Fig. 2) and 19 on the left side,

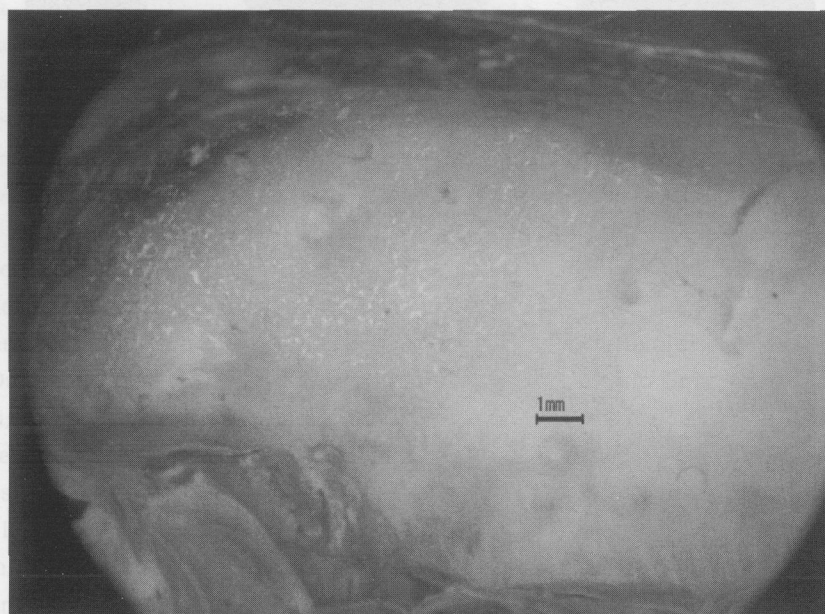


Fig. 2. Pearls embedded in the right mantle of *Mytilus galloprovincialis* from a rocky shore near Marcus Island, Saldanha Bay. Photographed after opening and being preserved in 95% alcohol.

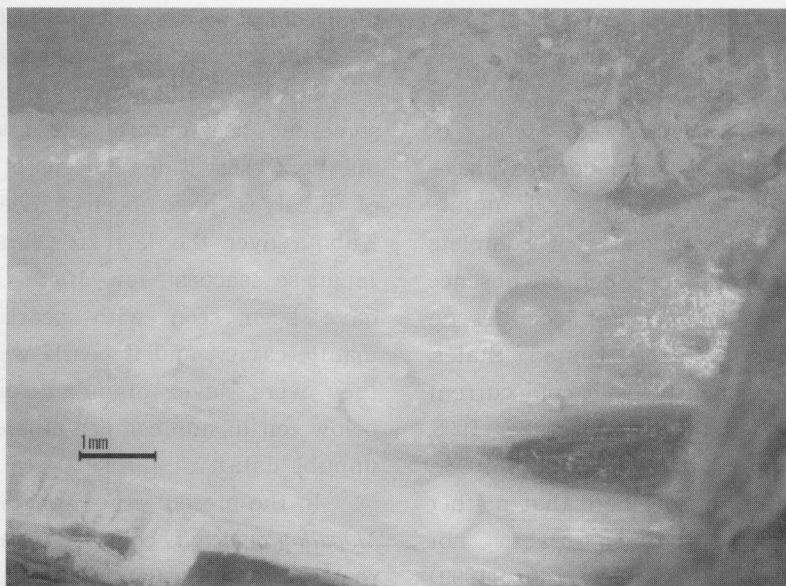


Fig. 3. Pearl-like protuberances on inner side of left shell of *Mytilus galloprovincialis*; same specimen as Fig. 2.

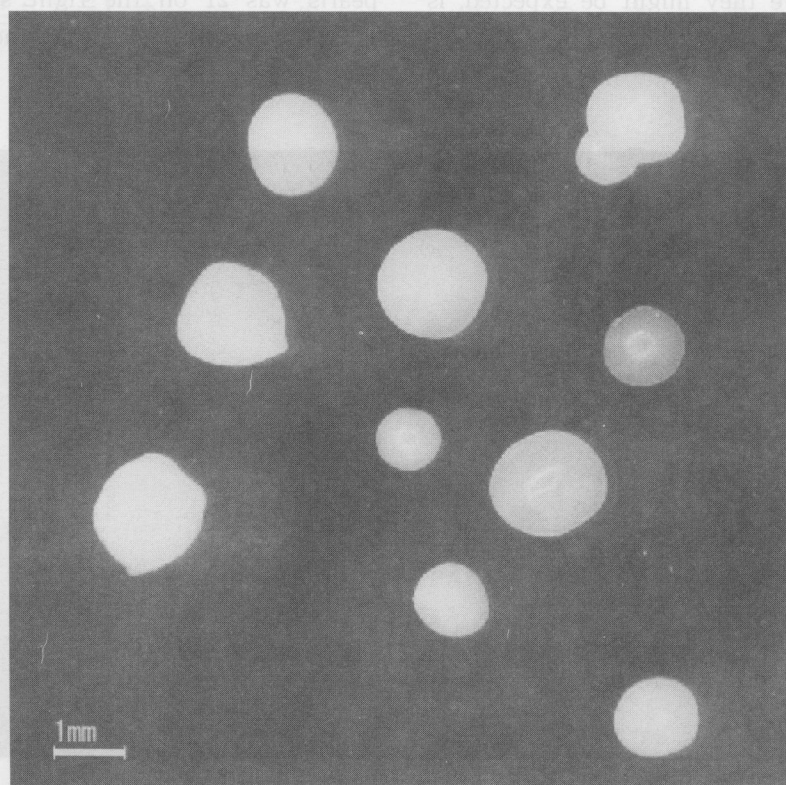


Fig. 4. Pearls of various shapes isolated from the left side mantle of *Mytilus galloprovincialis*; same specimen as Fig. 2.

thus 40 pearls in total in one mussel. Besides these numerous pearls, many protuberances resembling pearls also occurred on the inner side of the shell (Fig. 3). Most of the pearls were found aligned on the mantle just along the visceral mass. A few pearls were also distributed in the posterior part of the mantle all the way up to the dorsal margin (Fig. 2). Most of the pearls were nearly spherical, but some had protrusions (Fig. 4). All were small, attaining of up to 1.6 mm. The colour was variable, and some being pure white, but other slightly darker.

Besides the pearls described above, a few pearls, less than six in number per mussel, were found on two other occasions. One mussel came from the military jetty in Langebaan, the other from near Marcus Island, north of Langebaan Lagoon (Fig. 1).

Judging from the appearance of numerous, inner protuberances similar to the pearls, we think that a shock occurred that induced craking of the inner shell layer, then these shards become the cores of the pearls. At the same time, wounds that were not directly in the living mantle appeared as pearl-like protuberances.

It would be interesting to make more observations in the same area to try to find other mussels with a high number of pearls. On exposed coasts where the waves are strong, the probability of carrying a lot of alien particles such as sand or shell fragments into the mantle cavity of mussels leads to a higher possibility of developing pearls. The specific mussel found here did not come from an exposed area and this explanation can not then be the proper cause. However, even with an uncertified origin, the occurrence of these

40 pearls and other pearl-like protrusions is a very unusual phenomena.

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要 約

2003年1月に南アフリカ共和国南西端部附近のランゲバーン周辺海域の5地点で採集したムラサキイガイなどのイガイ類に付着するヒドロポリプ相を調査した。計489個体を検査した結果、貝殻表面に4種のヒドロポリプが見られた。一方、外套腔中に見られるカイヤドリヒドラ類は発見されなかった。1個体のムラサキイガイの左右の外套膜中に、例外的に多数(計40個)の真珠が形成されており、その貝殻内面にも真珠様の突起が多数形成されていた。

(2004年4月9日受理)